

## Analyses of PM<sub>10-2.5</sub> in Support of NAAQS & Monitoring Rule Proposals, Creation of PM<sub>10-2.5</sub> Database

In general, the estimated PM<sub>10-2.5</sub> database (db) was constructed largely from collocated (or nearby), same-day FRM/FEM PM<sub>10</sub> and PM<sub>2.5</sub> measurement pairs utilizing a simplistic difference computation. The following statements detail the PM<sub>10-2.5</sub> db construction:

- 24-hour duration data for the time period 2002 to 2004 were polled from AQS for the following parameters on November 21, 2005: Parameter 88101 [PM<sub>2.5</sub>, Local Conditions (LC)] and parameter 81102 [PM<sub>10</sub>, standard temperature and pressure conditions (STP)]
- Summary daily data (which includes hourly measurements aggregated within AQS to a 24-hour period) were extracted from AQS (also on November 21, 2005) for parameter 81102. AQS maintains the raw hourly data and also aggregates the hourly information into summary daily records. A summary record is only deemed 'valid' if 75% or more of the hourly data ( $\geq 18$ ) are present.
- 24-hour duration data for the time period 2002 to 2004 were retrieved from AQS for the following parameters on December 1, 2005: Parameter 68105 (average ambient temperature) and parameter 68108 (average barometric pressure).
- Only FRM/FEM PM<sub>10</sub> and PM<sub>2.5</sub> data were utilized. All AQS PM<sub>10</sub> data (except for a lone site in Alabama, ID '010970030' ... per David Mintz) were assumed to be FRM/FEM. PM<sub>2.5</sub> data were determined to be FRM/FEM based on method code. The following AQS method codes are considered FRM or FEM: 116, 117, 118, 119, 120, 123, 142, 143, 144, and 145. No effort was made to account for differences in sampling instruments or protocols between the co-located PM<sub>10</sub> and PM<sub>2.5</sub> monitors. Because of these differences (and other factors), occasionally the calculated PM<sub>10-2.5</sub> values were negative; this is not unexpected for two independent observations and negative PM<sub>10-2.5</sub> concentrations were not censored from the analyses.
- Collocated PM<sub>10</sub> and PM<sub>2.5</sub> data were paired. If at PM<sub>2.5</sub> monitor was not collocated with a PM<sub>2.5</sub> monitor, data from PM<sub>2.5</sub> monitors within 5 miles of the PM<sub>10</sub> site were paired with it. The PM<sub>10-2.5</sub> estimate was anchored at the PM<sub>10</sub> site. The assumption is that PM<sub>2.5</sub> is fairly spatially homogenous, but PM<sub>10</sub> is not. [The rationale for expanding the PM<sub>10-2.5</sub> db to include non-collocated pairs of data is as follows: Many 'high' PM<sub>10</sub> sites do not have collocated PM<sub>2.5</sub> because of disparate monitoring objectives. For PM<sub>10</sub> the central objective is 'highest concentration'; for PM<sub>2.5</sub> the main NAAQS objective is 'population exposure'. Hence, by not including these non-collocated pairs, we would be ignoring many potentially high PM<sub>10-2.5</sub> locations.] The 5 mile cutoff is somewhat arbitrary.
- Several PM<sub>10</sub> sites identified as source-oriented and not also population exposure were omitted from the extended database because it was felt that they were not likely candidates for a future PM<sub>10-2.5</sub> network. [These sites, identified by EPA regional staff, are (AQS Site ID's): '090090018', '290970003', '295100092', '401010167', '440070020', '450430006', '450630009', '560050874', '560050885', '560050891', '560050894', and '560050907'.]
- Data for verified source-impacted PM<sub>2.5</sub> sites were eliminated from consideration into the potential PM<sub>10-2.5</sub> database; these sites (it was felt) were not appropriate

candidates for future PM<sub>10-2.5</sub> network sites. The ten such sites are (AQS ID): ‘090090018’, ‘180890022’, ‘180970066’, ‘180970043’, ‘170311016’, ‘171190023’, ‘170990007’, ‘440070020’, ‘481410053’, and ‘291250001’.

- Both the PM<sub>10</sub> and PM<sub>2.5</sub> data used in the difference calculation were in units of µg/m<sup>3</sup> at local conditions, thus the calculated PM<sub>10-2.5</sub> values also are in those units. Parameter 81102 data, both summary and daily, were converted to local conditions using collocated temperature and pressure information. If collocated temperature and/or pressure data were not available, meteorological data from the nearest National Weather Service (NWS) station were used. (NWS data were provided by Bill Cox.) If collocated met data were not available and the NWS data were missing, the STP data were not converted to LC and not used in the analyses.
- Event-flagged PM<sub>10</sub> data were omitted from the processing. The concurrence field was not evaluated. (Thus, the PM<sub>10</sub> flagging was used as a surrogate for PM<sub>10-2.5</sub> flagging.)
- PM<sub>10-2.5</sub> estimates were constructed from all site-day pairs of collocated PM<sub>10</sub> and PM<sub>2.5</sub> measurements. E.g., If for a particular site day, there were two readings of PM<sub>10</sub> (‘1’ and ‘2’) and two readings of PM<sub>2.5</sub> (‘a’ & ‘b’), then four total PM<sub>10-2.5</sub> estimates were generated (‘1a’, ‘1b’, ‘2a’, and ‘2b’).
- In situations where multiple site-day estimates of PM<sub>10-2.5</sub> existed (combination of difference method pair estimates), they were averaged to obtain an average PM<sub>10-2.5</sub> measurement for the site-day. This average was considered the actual PM<sub>10-2.5</sub> estimate or ‘sample’ for that site-day (and counts as only one observation towards data completeness). Thus, data were essentially processed on a ‘site’ basis.
- To be used in subsequent analyses, a site needed 4, 8, or 12 consecutive quarters (2002-2004) of 11+ samples. This requirement is in contrast to typical PM<sub>2.5</sub> and PM<sub>10</sub> analyses which require ‘completeness’ in all 12 quarters; the PM<sub>10-2.5</sub> criteria is more relaxed to maximize the number of usable sites. Though nationally and regionally there are a sufficient number of 12-quarter complete PM<sub>25</sub> sites and also a sufficient number of 12-quarter complete PM<sub>10</sub> sites, there are not a sufficient number of *collocated* (or nearby) 12-quarter complete PM<sub>2.5</sub> and PM<sub>10</sub> sites, Specifically, the PM<sub>10-2.5</sub> analyses utilized the most recent 4, 8, or 12 consecutive quarters of 11 or more samples. A simple example is shown below. For this example site, the quarters that would have been utilized are shaded. Since the selection criterion evaluates available data in increments of 4 quarters, previous quarters could not be used due to the shortfall in 2003, quarter 1. An additional increment of 4 consecutive quarters meets the 11 minimum sample threshold (2002, quarters 1-4), but would not have been used since a more recent band of data (shaded) were available. Although the utilized selection criteria do not guarantee a calendar year(s) of data, it does provide at least one full year consisting of four quarters, thus reducing seasonal bias. Data present in quarters not part of the 4-, 8-, or 12-quarter period of interest were deleted and thus, not included in subsequent analyses.

Year / Quarter	2002, Q1	2002, Q2	2002, Q3	2002, Q4	2003, Q1	2003, Q2	2003, Q3	2003, Q4	2004, Q1	2004, Q2	2004, Q3	2004, Q4
N=	12	13	14	15	10	15	16	14	15	13	11	9

- 672 sites met completeness requirements: 228 with 4 complete quarters, 141 with 8 complete quarters, and 303 with all 12 complete quarters.

- ‘Annual’ 98<sup>th</sup> percentiles were computed from ‘annualized’ (4-quarter increment) statistics. [E.g., Assume a site had 8 complete quarters starting with 2002-Q3 and ending with 2004-Q2. Two ‘annual’ 98th percentiles were computed, one for 2002-Q3 through 2003-Q2 and the other for 2003-Q3 through 2004-Q2. The 2 ‘annual’ numbers (two 98<sup>th</sup> percentiles) were then averaged to obtain the site’s DV-type metrics.] Hence, the DV-type metric might represent 4, 8, or 12 quarters of data.
- A subset of the 672-site PM<sub>10-2.5</sub> database was used to estimate DV’s at locations consistent with the qualified PM<sub>10-2.5</sub> ‘urban’ indicator in the NAAQS proposal. The proposed PM<sub>10-2.5</sub> monitoring requirements stipulate an explicit ‘suitability test’ for NAAQS comparability: 1) the site must be located within an MSA and urbanized area of 100K population; 2) within that area, in a contiguous Census block group of 500 people/miles<sup>2</sup> or block/block group enclave of less than 5 miles<sup>2</sup>; 3) population oriented; 4) not source oriented / micro-scale environment; and 5) pass a site-specific assessment to confirm domination of qualified emissions. The first two criteria were checked for the ‘urban’ subset; the other three criteria were not. 417 sites met the ‘urban’ criteria: 123 with 4 complete quarters, 87 with 8 complete quarters, and 207 with all 12 complete quarters.
- The map on the next page shows all 672 sites for which PM<sub>10-2.5</sub> DV estimates were generate. The 417 ‘urban’ sites are identified with a unique symbol.
- Questions about the PM<sub>10-2.5</sub> database should be directed to Mark Schmidt at [Schmidt.mark@epa.gov](mailto:Schmidt.mark@epa.gov) or (919) 541-2416.

# Sites with PM<sub>10-2.5</sub> Design Value estimates, 2002-2004

[Red markers denote 'urban' sites; black dots are all others]

